

Claim Listing

1. (Previously Amended) A displacement sensor for a substance dispensing device having a translating piston, the sensor comprising:
 - a. a plunger rod coupled to the piston bearing an encoded pattern of encoding features, the spacing of the encoding features from one another defining spaces therebetween such that any two adjacent spaces form a unique sequence;
 - b. a light source for illuminating the encoded pattern;
 - c. a detector array for detecting light from the illuminated encoded pattern and generating a detector signal; and
 - d. a processor for determining a displacement of the plunger rod relative to a fiducial reference position based at least on the detector signal.
2. (Original) A displacement sensor according to claim 1, wherein the encoding features are regions of modulated optical transmission through the plunger rod.
3. (Original) A displacement sensor according to claim 1, wherein the encoding features are regions of modulated optical reflection by the plunger rod.
4. (Original) A displacement sensor according to claim 1, wherein the encoding features are a plurality of slots of enhanced transmission through the plunger rod.
5. (Original) A displacement sensor according to claim 4, wherein each slot is displaced from each pair of nearest neighbors by a unique combination of distances.
6. (Original) A displacement sensor according to claim 4, wherein the combination of any two adjacent spaces between slots uniquely identifies a characteristic of the reservoir.
7. (Original) A displacement sensor according to claim 6, wherein the identified characteristic of the reservoir is a displacement relative to a fiducial position.
8. (Original) A displacement sensor according to claim 6, wherein the identified characteristic of the reservoir is content of a reservoir to which the plunger rod pertains.
9. (Original) A displacement sensor according to claim 6, wherein the identified characteristic of the reservoir includes at least one of diameter and wall composition material.
10. (Original) A displacement sensor according to claim 1, wherein the light source includes an optical diffuser for illuminating a region of the plunger rod with substantially uniform optical intensity.

11. (Original) A displacement sensor according to claim 1, wherein the encoded pattern of encoding features repeats along the plunger rod.
12. (Previously Amended) A dispensing apparatus comprising:
 - a. a reservoir having a cylindrical inner volume for containing a substance;
 - b. a plunger rod for impelling a piston along a linear axis of motion within the inner volume of the reservoir in order to displace and dispense a measured quantity of the substance;
 - c. an encoding pattern of encoding features disposed along the plunger rod in a direction parallel to the linear axis of motion of the piston, the spacing of the encoding features from one another defining spaces therebetween such that any two adjacent spaces form a unique sequence;
 - d. an illumination source for illuminating the encoded pattern;
 - e. a detector array for detecting light from the illuminated encoded pattern and generating a detector signal; and
 - f. a processor for determining a displacement of the plunger rod relative to a fiducial reference position based at least on the detector signal.
13. (Original) A dispensing apparatus according to claim 12, wherein the encoding features are regions of modulated optical transmission through the plunger rod.
14. (Original) A dispensing apparatus according to claim 12, wherein the encoding features are a plurality of slots of enhanced transmission through the plunger rod.
15. (Original) A dispensing apparatus according to claim 14, wherein each slot is displaced from the pair of nearest neighbors by a unique combination of distances.
16. (Original) A dispensing apparatus according to claim 12, having more than 1 reservoir version, wherein the encoding pattern is uniquely determinative of a version of the reservoir.
17. (Previously Amended) A method for measuring a rate of dispensing a substance by means of a dispenser having a piston driven along an axis of motion within a reservoir of the substance, the method comprising:
 - a. illuminating with an illumination source an encoded pattern of encoding features disposed upon a plunger rod coupled to the piston, the spacing of the encoding features from one another defining spaces therebetween such that any two adjacent spaces form a unique sequence;

- b. detecting light from the illuminated encoding features and generating a detector signal; and;
 - c. determining a displacement of the plunger rod relative to a fiducial reference position based at least on the detector signal.
18. (Original) A method according to claim 17, wherein the step of detecting light further includes acquiring an image of the illuminated encoding features.
19. (Original) A method according to claim 17, wherein the step of determining a displacement further includes determining positions of peaks of light transmission through the encoding features.
20. (Original) A method according to claim 17, further including the step of storing each successive detector array value in each of successive groups of n software array elements.